CLAIMS

What is claimed is:

1. A tunable Fabry-Perot filter, comprising:

a pair of opposed, at least partially reflective surfaces defining an optical cavity; and

a nano-dispersion of liquid crystals disposed in said cavity.

2. The filter according to claim 1, wherein said liquid crystals are disposed in an array in a metal-oxide matrix.

3. The filter according to claim 1, wherein said liquid crystals are disposed in an array of holes in a metal-oxide matrix.

4. The filter according to claim 1, wherein said liquid crystals are disposed in an array of holes in a metal-oxide matrix, the metal oxide being taken from the group consisting of TiO_2, SiO_2 and ZiO_2.

5. The filter according to claim 3, wherein said metal-oxide matrix is TiO_2.

6. The filter according to claim 1, wherein said liquid crystals are disposed in an irregular array of generally spherical holes in a metal-oxide matrix.

7. The filter according to claim 6, wherein said holes are on the order of about 10 to 50 nm in diameter.

8. The filter according to claim 6, wherein said holes make up at least fifty percent of the volume of said matrix.

9. The filter according to claim 6, wherein said holes make up no more than about sixty-eight percent of the volume of said matrix.

10. The filter according to claim 6, wherein said holes make up from about fifty percent to about sixty-eighty percent of the volume of said matrix.

11. The filter according to claim 1, wherein said liquid crystals are in droplet form, said droplets being smaller than the optical wavelengths to be passed through the filter.

12. The filter according to claim 1, and further comprising means for applying an electric field to said liquid crystals.

13. The filter according to claim 12, wherein the optical wavelengths which the filter passes are tunable by varying the electric field applied across said optical cavity.

14. A tunable Fabry-Perot filter, comprising:

a pair of opposed, at least partially reflective, generally parallel surfaces defining a cavity; and

a nano-dispersion of liquid crystals disposed in an array in a metal-oxide matrix in said cavity.

15. The filter according to claim 14, wherein said liquid crystals are disposed in an array of substantially spherical holes in said metal-oxide matrix.

16. The filter according to claim 14, wherein said holes are on the order of about 10 to 50 nm in diameter and make up from about fifty percent to about sixty-eighty percent of the volume of said matrix.

17. The filter according to claim 15, wherein said metal-oxide matrix is formed of metal oxides taken from the group consisting of TiO_2, SiO_2 and ZiO_2.

18. The filter according to claim 14, wherein said liquid crystals are in droplet form, said droplets being smaller than the optical wavelengths to be passed through the filter.

19. The filter according to claim 15, and further comprising means for applying an electric field to said liquid crystals.

20. The filter according to claim 19, wherein the optical wavelengths which the filter passes are tunable by varying the electric field applied across said cavity containing said liquid crystals.

21. A method of making tunable Fabry-Perot filter, comprising the steps of:

providing a pair of opposed, at least partially reflective, generally parallel surfaces;

positioning said at least partially reflective surfaces to define a cavity therebetween; and

placing a nano-dispersion of liquid crystals disposed in an irregular array in a metal-oxide matrix in said cavity.

22. The method according to claim 21, wherein the liquid crystals are disposed in an array of substantially spherical holes in a metal-oxide matrix.

23. The method according to claim 22, wherein the holes are on the order of about 10 to 50 nm in diameter and make up from about fifty percent to about sixty-eight percent of the volume of the matrix.

24. The method according to claim 21, wherein the matrix is formed of a metal oxide taken from the group consisting of TiO_2, SiO_2 and ZiO_2.

25. The method according to claim 21, wherein formation of the metal-oxide matrix comprises of the steps of:

selecting a quantity of polymer balls having a predetermined size;

selecting a quantity of particles of metal oxide having a predetermined size;

mixing the polymer balls with the particles of titanium oxide;

placing the mixture within a form;

applying sufficient heat to the mixture in the form to burn off the polymer balls and fuse the metal oxide, thereby forming a matrix of generally spherical holes; and

introducing liquid crystal into the holes in the matrix.

26. The method according to claim 25, wherein the liquid crystal is introduced into the matrix by means of a vacuum.

27. The method according to claim 25, wherein the metal oxide is taken from the group consisting of TiO_2, SiO_2 and ZiO_2.

28. The method according to claim 21, wherein the liquid crystals are in droplet form, said droplets being smaller than the optical wavelengths to be passed through the filter.

29. The method according to claim 21, and comprising the further step of providing means for applying an electric field across the cavity.

30. The method according to claim 29, wherein the optical wavelengths which the filter passes are tunable by varying the electric field applied across the liquid crystal cavity.

31. A method of using a tunable Fabry-Perot filter to selectively pass optical frequencies therethrough, the filter being formed of a cavity defined by at least partially reflective, generally parallel, spaced surfaces, with a metal-oxide matrix having an irregular array of holes therein filled with liquid crystal material, the method comprising:

injecting optical signals into the tunable filter; and

applying a controllable electric field across the filter to tune the resonant frequency of the cavity to thereby pass optical signals having selected frequencies.

32. The method according to claim 31, wherein the resonant frequency of the liquid crystal cavity is varied by changing the refractive index of the liquid crystals therein in response to the electric field applied across the filter.